

# A MACROECONOMIC APPROACH TO OPTIMAL UNEMPLOYMENT INSURANCE

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Paper available at <https://www.pascalmichaillat.org/4.html>

# BAILY-CHETTY THEORY OF OPTIMAL UI

- insurance-incentive tradeoff:
  - UI provides consumption insurance
  - but UI reduces job search
- two aspects of the debate are missing:
  - sometimes jobs may be unavailable
  - UI may affect job creation
- because the Baily-Chetty model is partial equilibrium:
  - endogenous labor supply
  - but fixed labor market tightness

# THIS PAPER

- general-equilibrium model of optimal UI
  - endogenous labor supply
  - endogenous labor demand
  - equilibrium labor market tightness
- model captures 3 effects of UI:
  - UI may reduce job search
  - UI may alleviate rat race for jobs
  - UI may raise wages and deter job creation
- application: optimal UI over the business cycle

# A MATCHING MODEL OF UI

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# UI PROGRAM

- moral hazard: search effort is unobservable
- employed workers receive  $c^e$
- unemployed workers receive  $c^u$
- replacement rate  $R$  measures generosity of UI:
  - $R \equiv 1 - (c^e - c^u)/w$
  - $R$  = benefit rate + tax rate
  - workers keep fraction  $1 - R$  of earnings

# LABOR MARKET

- measure 1 of identical workers, initially unemployed
  - search for jobs with effort  $e$
- measure 1 of identical firms
  - post  $v$  vacancies to hire workers
- CRS matching function:  $l = m_{++}(e, v)$
- labor market tightness:  $\theta \equiv v/e$

# MATCHING PROBABILITIES

- vacancy-filling probability:

$$q(\theta) \equiv \frac{l}{v} = m\left(\frac{1}{\theta}, 1\right)$$

- job-finding rate per unit of effort:

$$f(\theta) \equiv \frac{l}{e} = m(1, \theta)$$

- job-finding probability:  $e \cdot f(\theta) < 1$

## MATCHING COST: $\rho$ RECRUITERS PER VACANCY

- employees =  $\left[1 + \tau(\theta)\right] \cdot \text{producers}$
- proof:

$$\underbrace{l}_{\text{employees}} = \underbrace{n}_{\text{producers}} + \underbrace{\rho \cdot v}_{\text{recruiters}}$$

$$l = n + \rho \cdot \frac{l}{q(\theta)}$$

$$l = \underbrace{\left[1 + \frac{\rho}{q(\theta) - \rho}\right]}_{\equiv 1 + \tau(\theta)} \cdot n$$



# REPRESENTATIVE WORKER

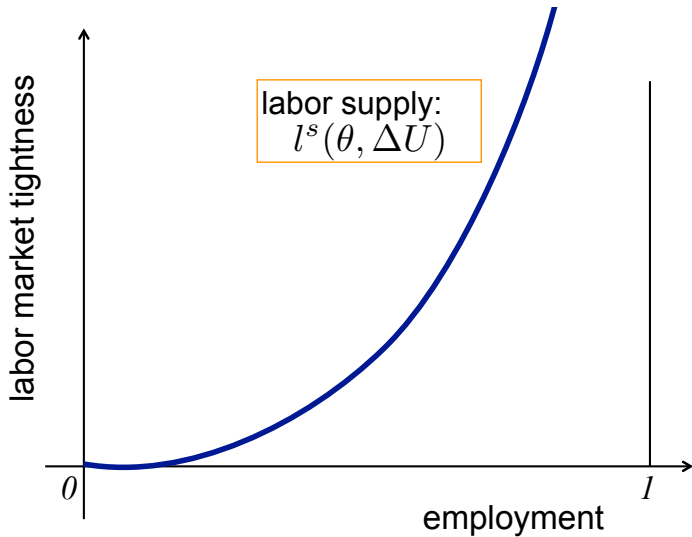
- consumption utility  $U(c)$ , search disutility  $\psi(e)$
- utility gain from work:  $\Delta U \equiv U(c^e) - U(c^u)$
- solves  $\max_e \{ U(c^u) + e \cdot f(\theta) \cdot \Delta U - \psi(e) \}$
- effort supply  $e^s(\theta, \Delta U)$  gives optimal effort:

$$\psi'(e^s(\theta, \Delta U)) = f(\theta) \cdot \Delta U$$

- labor supply  $l^s(\theta, \Delta U)$  gives employment rate:

$$l^s(\theta, \Delta U) = e^s(\theta, \Delta U) \cdot f(\theta)$$

# LABOR SUPPLY

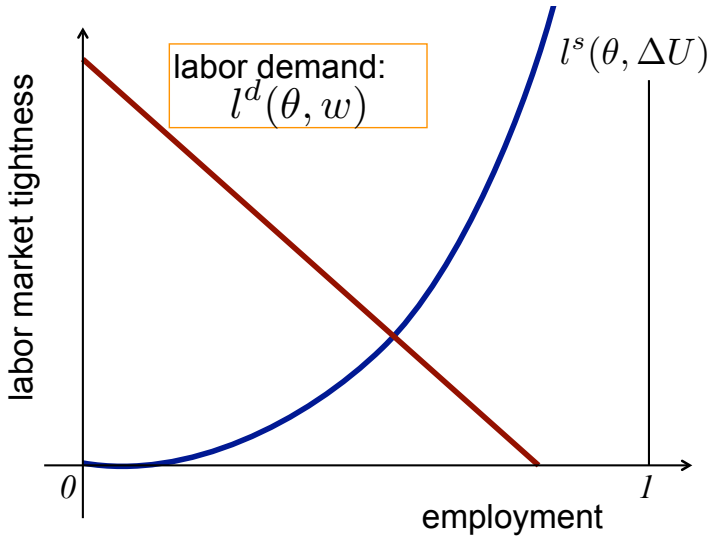


## REPRESENTATIVE FIRM

- hires  $l$  employees
  - $n = l/[1 + \tau(\theta)]$  producers
  - $l - n$  recruiters
- production function:  $y(n)$
- solves  $\max_l \{ y(l/[1 + \tau(\theta)]) - w \cdot l \}$
- labor demand  $l^d(\underline{\theta}, \underline{w})$  gives optimal employment:

$$y' \left( \frac{l^d}{1 + \tau(\theta)} \right) = [1 + \tau(\theta)] \cdot w$$

# LABOR DEMAND



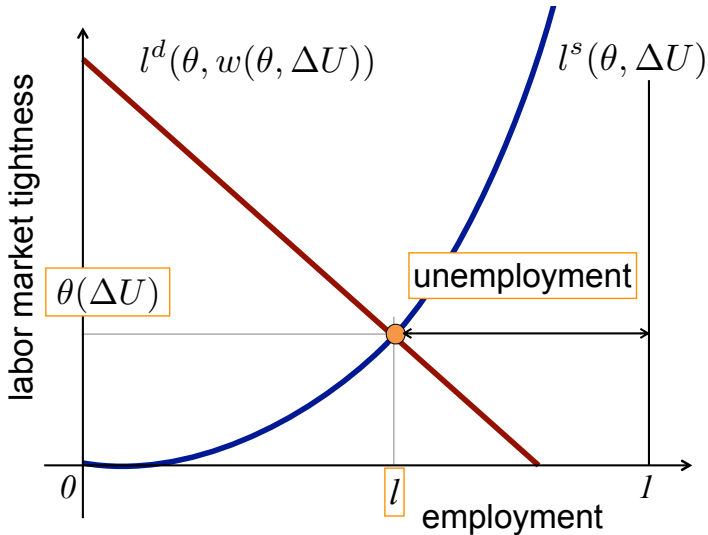
# LABOR-MARKET EQUILIBRIUM

- as in any matching model, need a price mechanism
  - general wage schedule:  $w = w(\theta, \Delta U)$
- tightness equilibrates supply & demand:

$$l^s(\theta, \Delta U) = l^d(\theta, w(\theta, \Delta U))$$

- equilibrium tightness:  $\theta(\Delta U)$

# LABOR-MARKET EQUILIBRIUM



# SUFFICIENT-STATISTIC FORMULA FOR OPTIMAL UI

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# GOVERNMENT'S PROBLEM

- choose  $\Delta U$  to maximize welfare:

$$SW = l \cdot U(c^e) + (1 - l) \cdot U(c^u) - \psi(e)$$

- subject to budget constraint:

$$y \left( \frac{l}{1 + \tau(\theta)} \right) = l \cdot c^e + (1 - l) \cdot c^u$$

- to workers' response:  $e = e^s(\theta, \Delta U)$  &  $l = l^s(\theta, \Delta U)$
- and to **equilibrium constraint**:  $\theta = \theta(\Delta U)$



## CONDITION FOR OPTIMAL UI

- express all the variables as a function of  $(\theta, \Delta U)$
- government solves  $\max_{\Delta U} SW(\theta(\Delta U), \Delta U)$
- first-order condition:

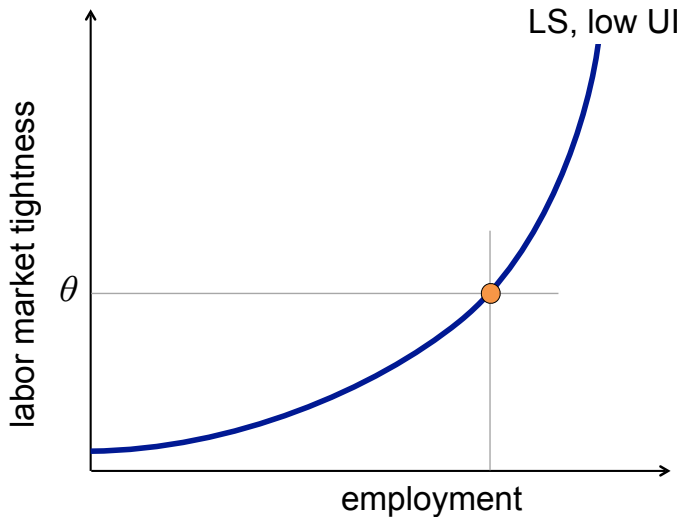
$$\underbrace{0 = \frac{\partial SW}{\partial \Delta U} \Big|_{\theta}}_{\text{Bailey-Chetty formula}} + \underbrace{\frac{\partial SW}{\partial \theta} \Big|_{\Delta U} \cdot \frac{d\theta}{d\Delta U}}_{\text{correction}}$$

## BAILY-CHETTY FORMULA

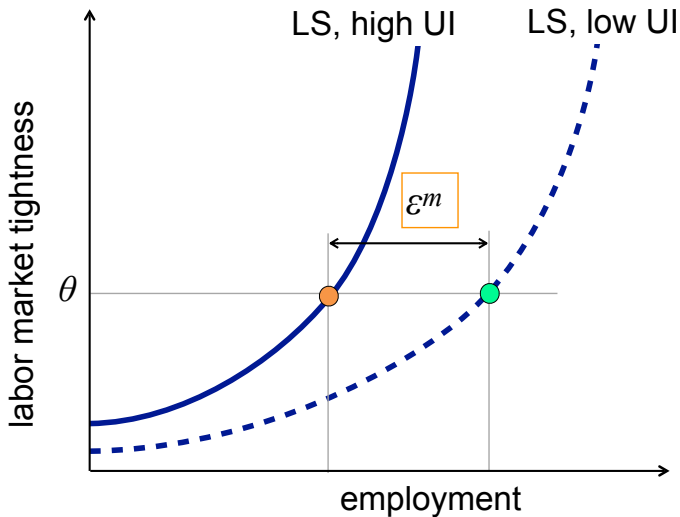
$$R = R^* \left( \epsilon^m, \frac{U'(c^u)}{U'(c^e)} \right)$$

- $\epsilon^m > 0$ : microelasticity of unemployment wrt UI
  - measures disincentive from search
  - $R^*$  is decreasing in  $\epsilon^m$
- $U'(c^u)/U'(c^e) > 1$ : ratio of marginal utilities
  - measures need for insurance
  - $R^*$  is increasing in  $U'(c^u)/U'(c^e)$

# MICROELASTICITY OF UNEMPLOYMENT



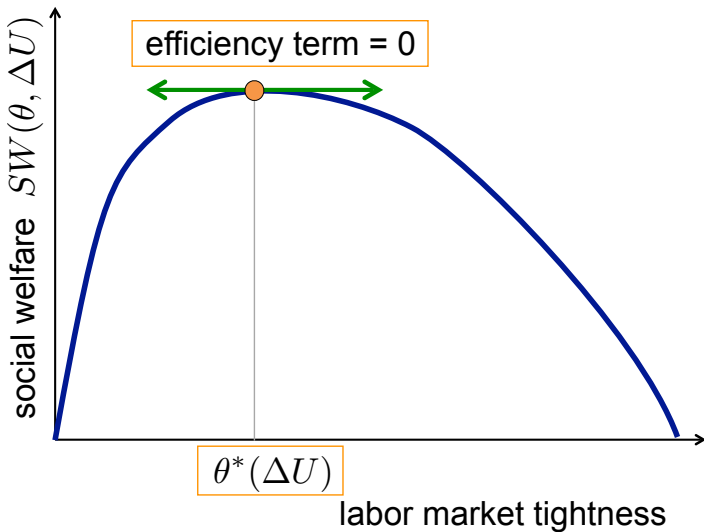
# MICROELASTICITY OF UNEMPLOYMENT



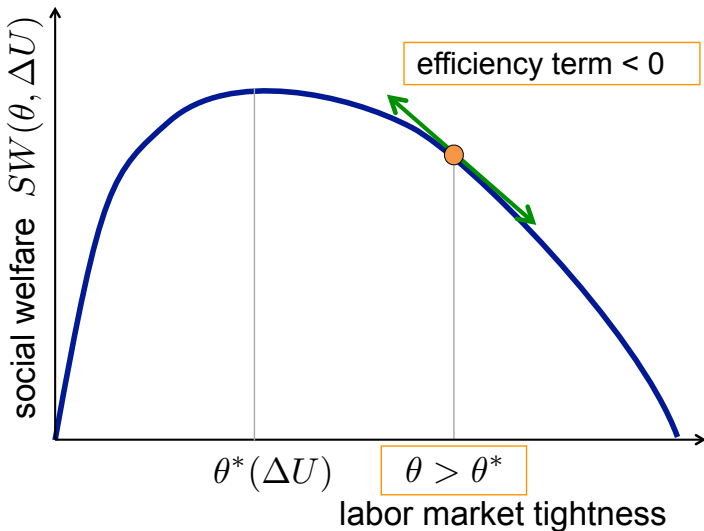
## $\partial SW / \partial \theta |_{\Delta U}$ MEASURED BY EFFICIENCY TERM

- efficiency term depends on several sufficient statistics:
  - $\tau(\theta)$ : recruiter-producer ratio
  - $u$ : unemployment rate
  - $1 - \eta$ : elasticity of the job-finding rate  $f(\theta)$
  - $\Delta U$ : the utility gain from work

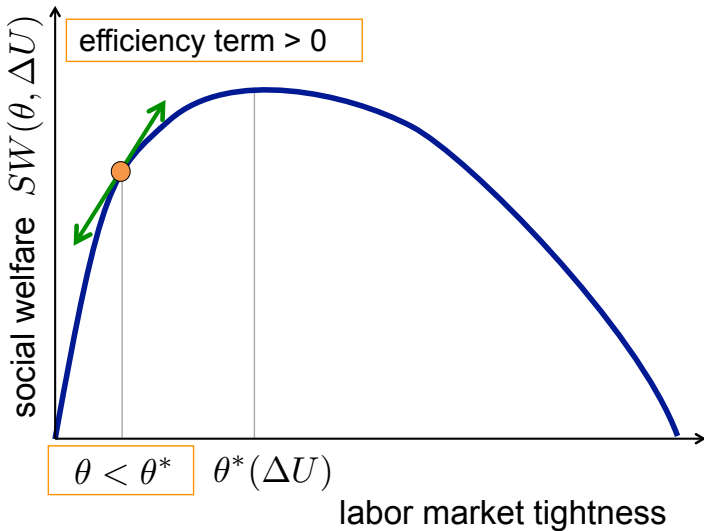
## EFFICIENCY TERM AND EFFICIENT TIGHTNESS



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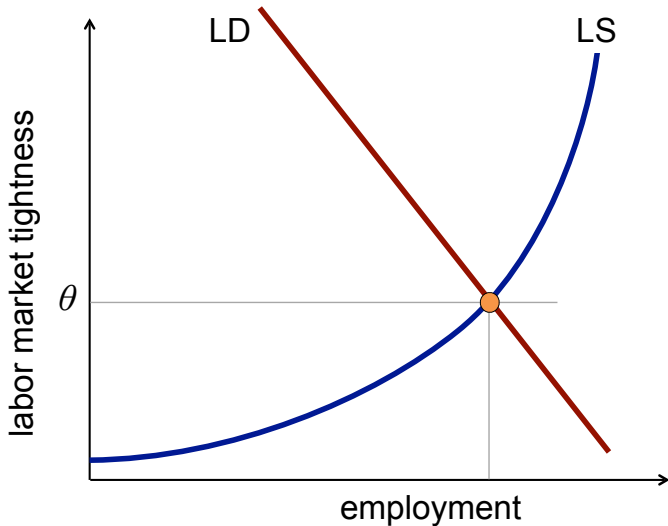


## EFFICIENCY TERM AND EFFICIENT TIGHTNESS

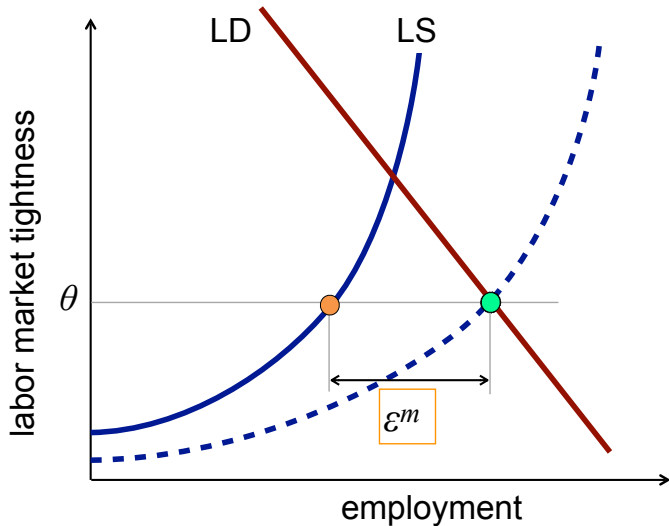




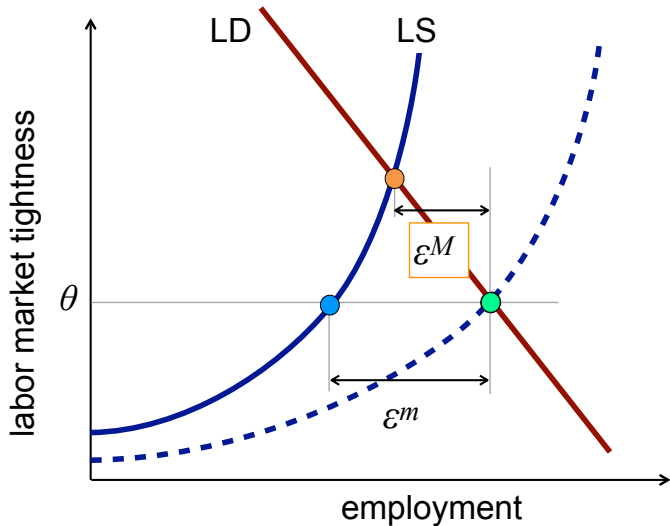
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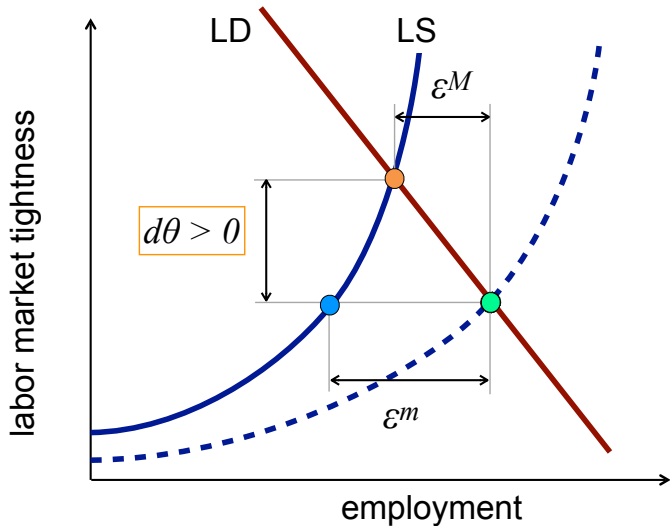
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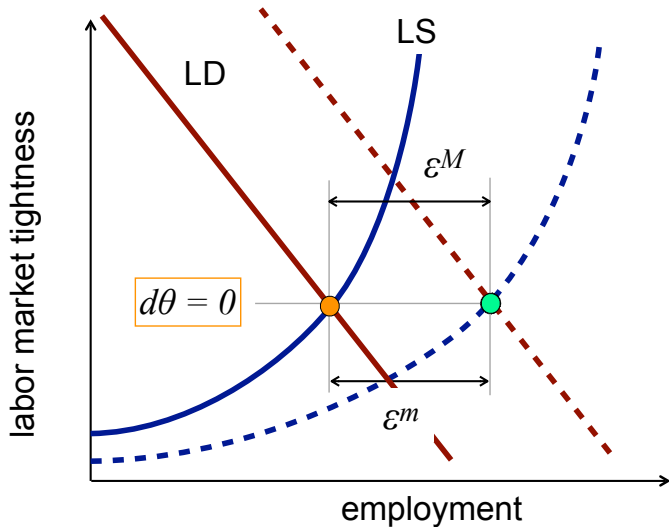
# MACROELASTICITY OF UNEMPLOYMENT



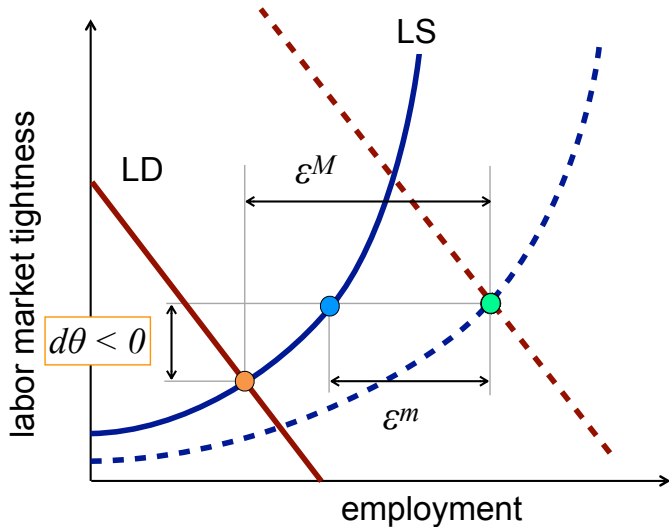
$1 - \epsilon^M / \epsilon^m$  GIVES EFFECT OF UI ON  $\theta$



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# OPTIMAL UI FORMULA IN SUFFICIENT STATISTICS

$$\underbrace{R = R^* \left( \epsilon^m, \frac{U'(c^u)}{U'(c^e)} \right)}_{\text{Baily-Chetty formula}} + \underbrace{\left( 1 - \frac{\epsilon^M}{\epsilon^m} \right) \cdot \text{efficiency term}}_{\text{correction}}$$

# OPTIMAL UI VERSUS BAILY-CHETTY LEVEL

- optimal UI = Baily-Chetty if
    - UI has no effect on tightness:  $\epsilon^M = \epsilon^m$
    - or tightness is efficient: efficiency term = 0
  - optimal UI  $\neq$  Baily-Chetty if
    - UI affects tightness:  $\epsilon^M \neq \epsilon^m$
    - and tightness is inefficient: efficiency term  $\neq 0$
- ⇒ optimal UI > Baily-Chetty if UI pushes tightness toward efficiency



# OPTIMAL UI OVER THE BUSINESS CYCLE: THEORY

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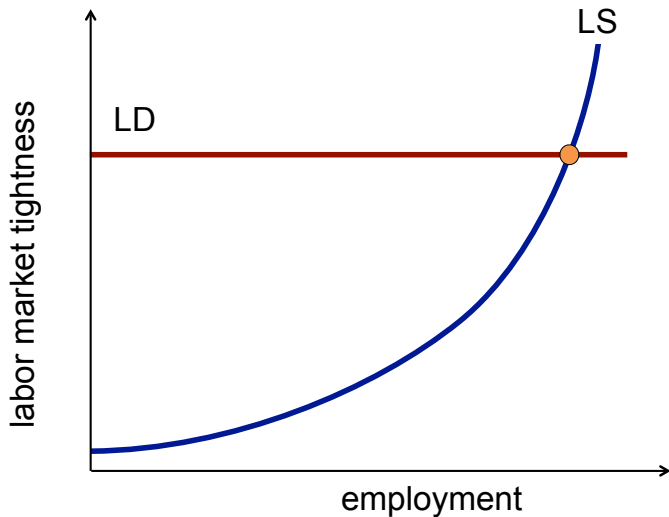
## THREE MATCHING MODELS

	model		
	standard	rigid-wage	job-rationing
prod. function	linear	linear	concave
wage	bargaining	rigid	rigid
reference	Pissarides [2000]	Hall [2005]	Michaillat [2012]

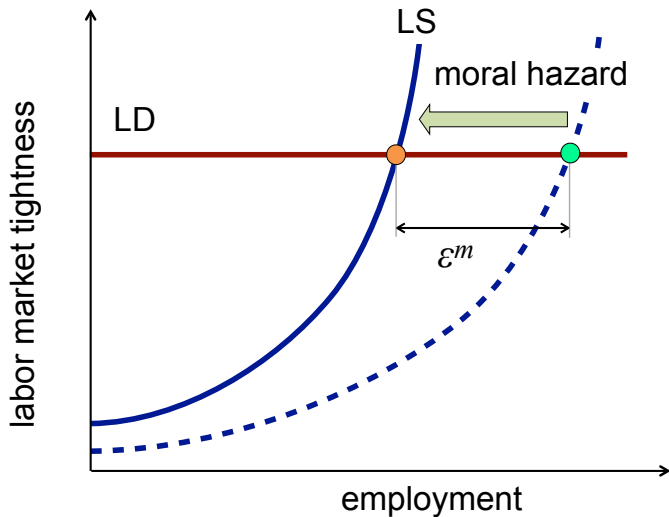
## BUSINESS CYCLES IN THE MODELS

- Baily-Chetty level is broadly constant
- $1 - \epsilon^M / \epsilon^m$  has constant sign
- efficiency term changes sign over business cycle
  - under labor demand shocks
  - $> 0$  in slumps and  $< 0$  in booms
  - generates cyclicalities of optimal UI

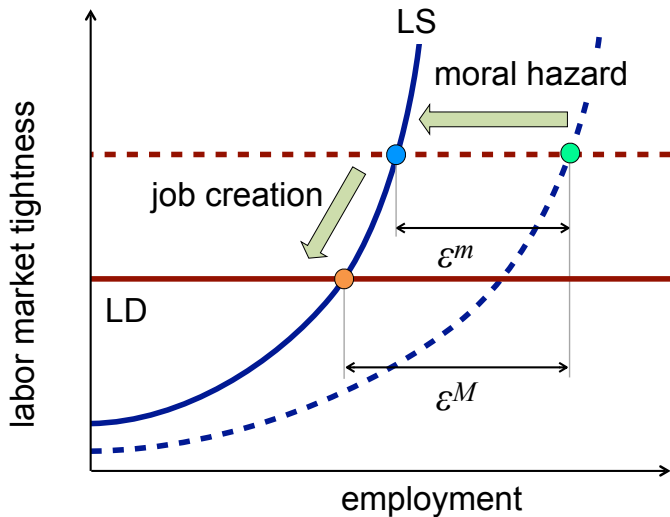
STANDARD MODEL:  $1 - \epsilon^M / \epsilon^m < 0$



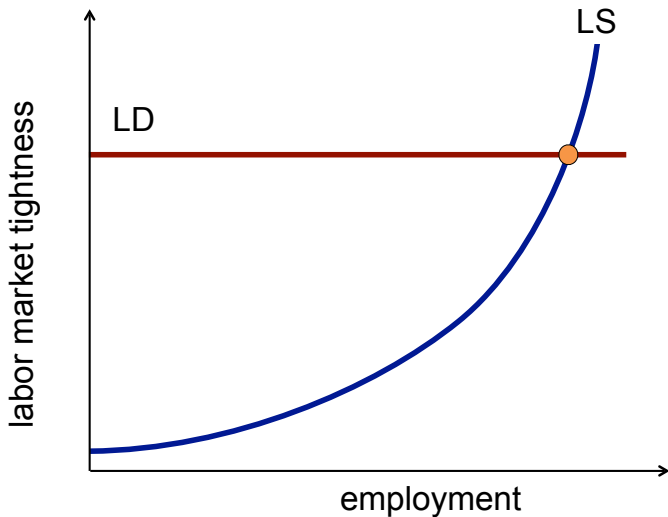
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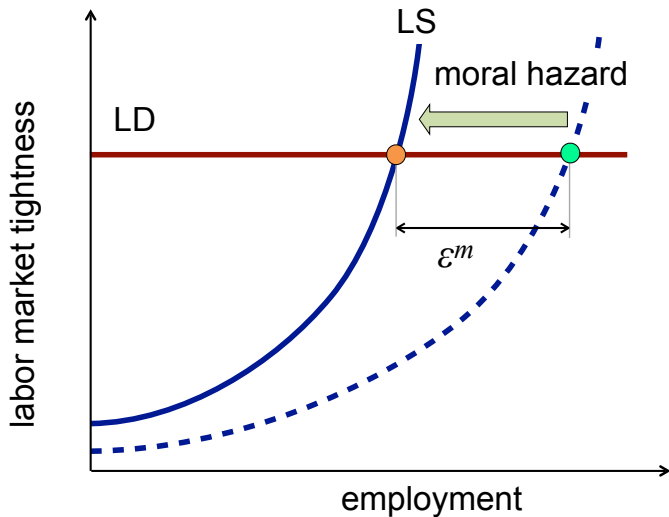
STANDARD MODEL:  $1 - \epsilon^M / \epsilon^m < 0$



RIGID-WAGE MODEL:  $1 - \epsilon^M / \epsilon^m = 0$

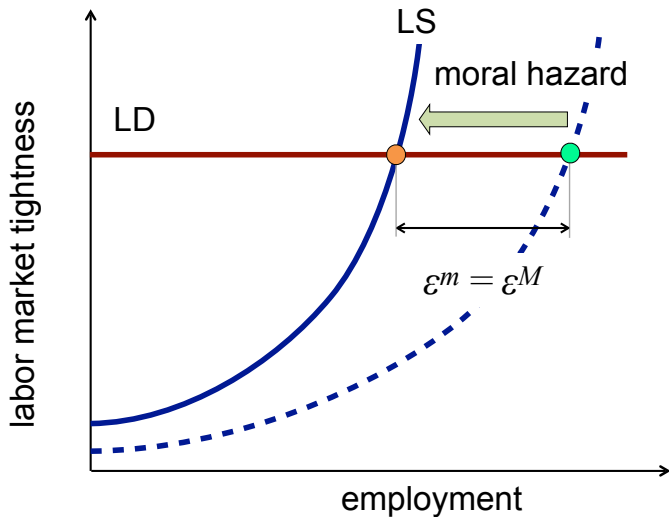


RIGID-WAGE MODEL:  $1 - \epsilon^M / \epsilon^m = 0$

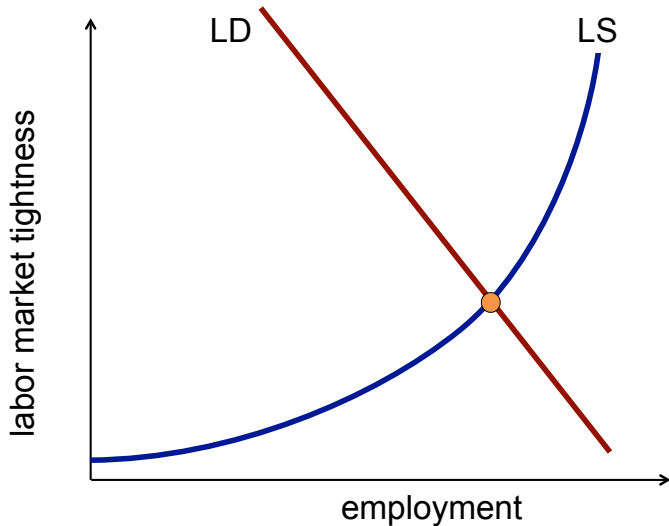




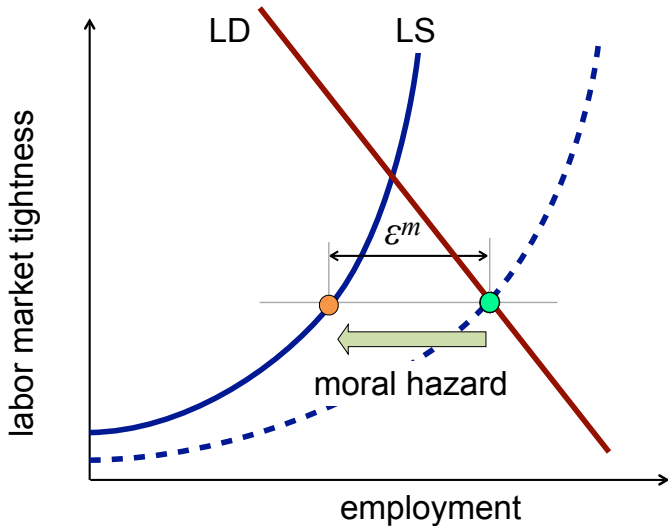
RIGID-WAGE MODEL:  $1 - \epsilon^M / \epsilon^m = 0$



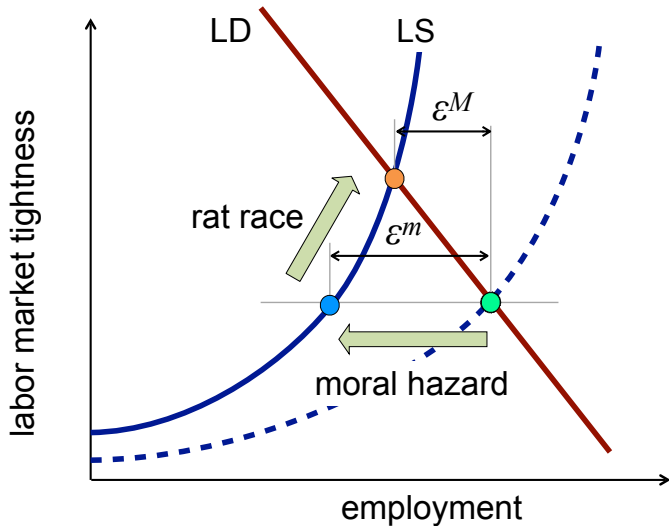
JOB-RATIONING MODEL:  $1 - \epsilon^M / \epsilon^m > 0$



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JOB-RATIONING MODEL:  $1 - \epsilon^M / \epsilon^m > 0$



# CYCLICALITY OF OPTIMAL UI

- tightness is too low in slumps & too high in booms
- **standard model: procyclical UI**
  - moral hazard & job creation:  $1 - \epsilon^M/\epsilon^m < 0$
  - UI should be reduced in slumps to stimulate tightness
- **rigid-wage model: acyclical UI**
  - only moral hazard:  $1 - \epsilon^M/\epsilon^m = 0$
  - UI has no effect on tightness
- **job-rationing model: countercyclical UI**
  - moral hazard & rat race:  $1 - \epsilon^M/\epsilon^m > 0$
  - UI should be raised in slumps to stimulate tightness

# OPTIMAL UI OVER THE BUSINESS CYCLE: APPLICATION TO THE US

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# MICROELASTICITY OF UNEMPLOYMENT WRT UI

- many estimates of the microelasticity
- obtained by comparing identical jobseekers receiving different UI benefits in the same market
- plausible range of estimates:  $0.4 \leq \epsilon^m \leq 0.8$ 
  - estimates of the microelasticity of unemployment duration wrt potential duration of UI benefits
- key references:
  - Katz, Meyer [1990]
  - Landais [2015]

# MACROELASTICITY OF UNEMPLOYMENT WRT UI

- few estimates of the macroelasticity
- obtained by comparing identical labor markets receiving different UI benefits
- plausible range of estimates:  $0 \leq \epsilon^M \leq 0.3$
- key references:
  - Card, Levine [2000]
  - Hagedorn et al [2016]
  - Chodorow-Reich, Cogleianese, Karabarbounis [2019]
  - Dieterle, Bartalotti, Brummet [2020]
  - Boone et al [2021]



# COMPARING MICROELASTICITY & MACROELASTICITY

- estimates obtained separately suggest  $1 - \epsilon^M/\epsilon^m > 0$ :

$$0 < \epsilon^M < 0.3 < 0.4 < \epsilon^m < 0.8$$

- implied range for the elasticity wedge: 0.25–1
  - lower bound:  $1 - \epsilon^M/\epsilon^m = 1 - 0.3/0.4 = 0.25$
  - upper bound:  $1 - \epsilon^M/\epsilon^m = 1 - 0/0.8 = 1$
- one exception: Johnston, Mas [2018] find  $1 - \epsilon^M/\epsilon^m = 0$  when they estimate  $\epsilon^m$  and  $\epsilon^M$  in MO data

## RESPONSE OF TIGHTNESS TO UI

- Marinescu [2017] finds that an increase in UI raises tightness
  - corresponding elasticity wedge:  $1 - \epsilon^M / \epsilon^m = 0.4$
- Levine [1993] & Farber, Valletta [2015] find that an increase in UI leads uninsured jobseekers to find jobs faster
  - ~> an increase in UI raises tightness
  - ~>  $1 - \epsilon^M / \epsilon^m > 0$
- evidence from Austria: Lalive et al [2015] find that an increase in UI raises tightness
  - corresponding elasticity wedge:  $1 - \epsilon^M / \epsilon^m = 0.2$

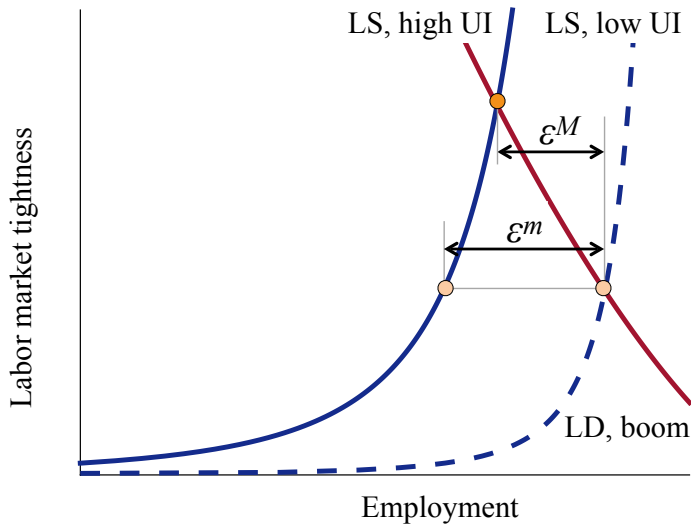
# RAT-RACE & JOB-CREATION CHANNELS

- RCT evidence of rat-race mechanism:
  - negative spillover of more intense job search
  - Crepon et al [2013] in France
  - Gautier et al [2012] in Denmark
- no evidence of job-creation mechanism:
  - re-employment wages unaffected by UI
  - Krueger, Mueller [2016]
  - Marinescu [2017]
  - Johnston, Mas [2018]
  - also true in Austria: Card et al [2007]

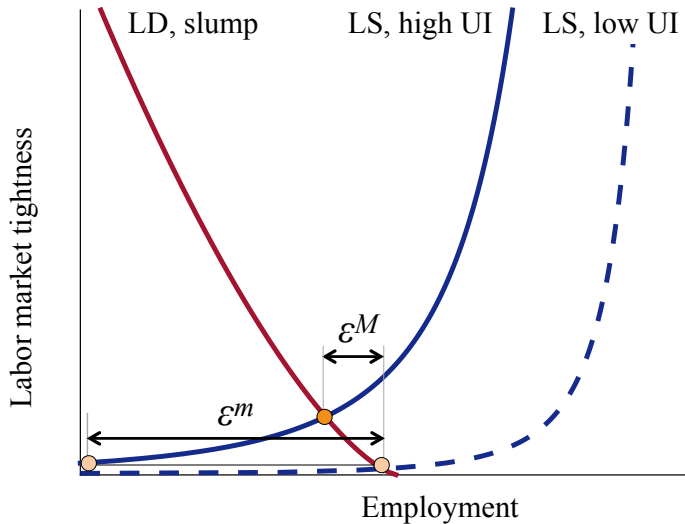
## SUMMARY OF THE EVIDENCE: $1 - \epsilon^M/\epsilon^m \approx 0.4$

- the evidence shows that  $1 - \epsilon^M/\epsilon^m \geq 0$ 
  - reasonable median estimate:  $1 - \epsilon^M/\epsilon^m = 0.4$
- the evidence supports the rat-race mechanism but not the job-creation mechanism
  - further support for  $1 - \epsilon^M/\epsilon^m > 0$
- additional evidence suggests that the elasticity wedge may be larger in bad times
  - Valletta [2014]
  - Toohey [2017]

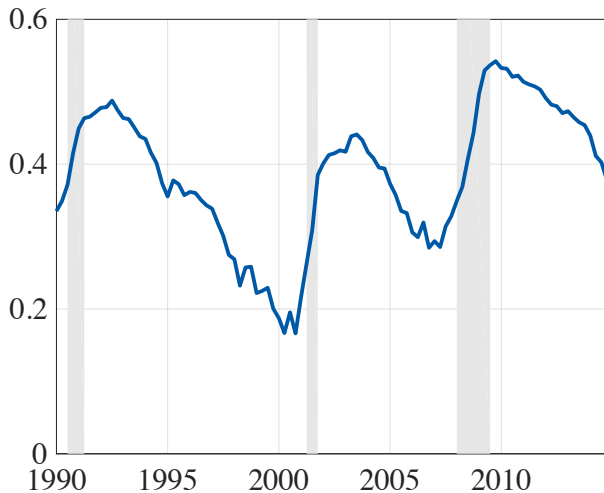
## ELASTICITY WEDGE IN GOOD TIMES



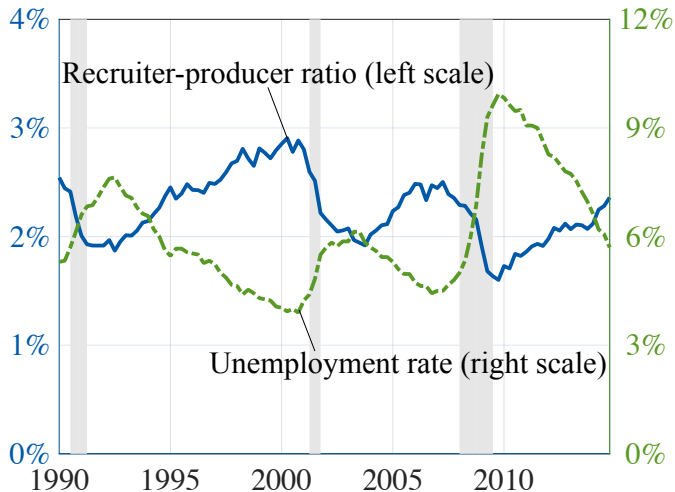
## ELASTICITY WEDGE IN BAD TIMES



## ELASTICITY WEDGE IN THE US

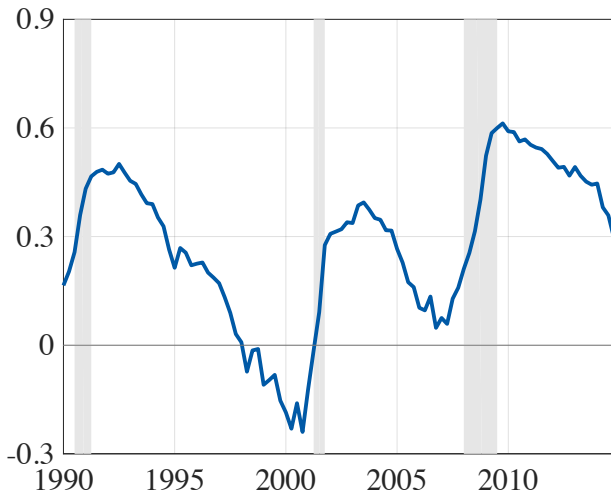


# JOBSEEKING & RECRUITING IN THE US

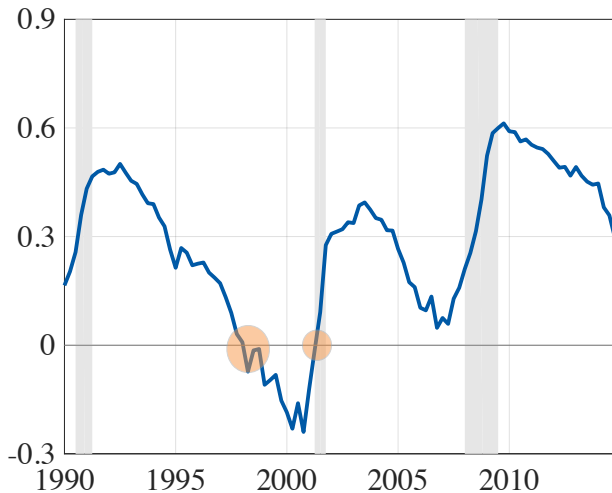




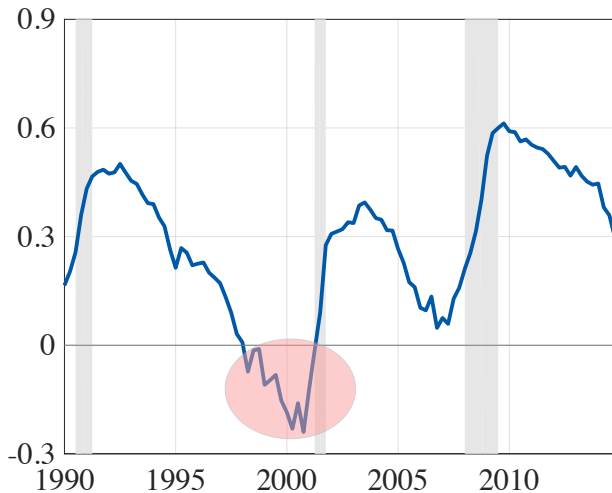
## EFFICIENCY TERM IN THE US



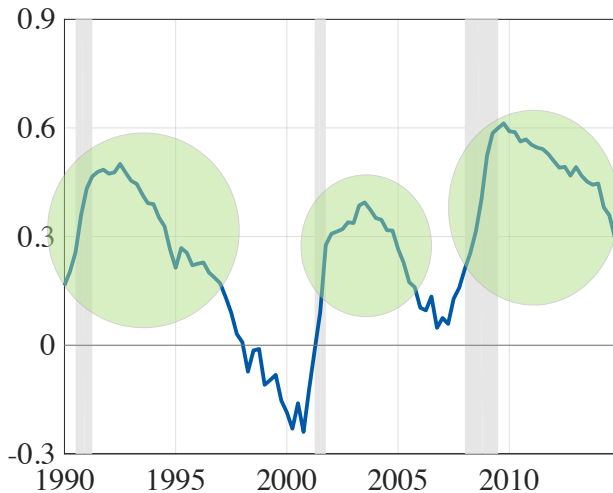
EFFICIENCY TERM = 0  $\Rightarrow$  UI = BAILY-CHETTY



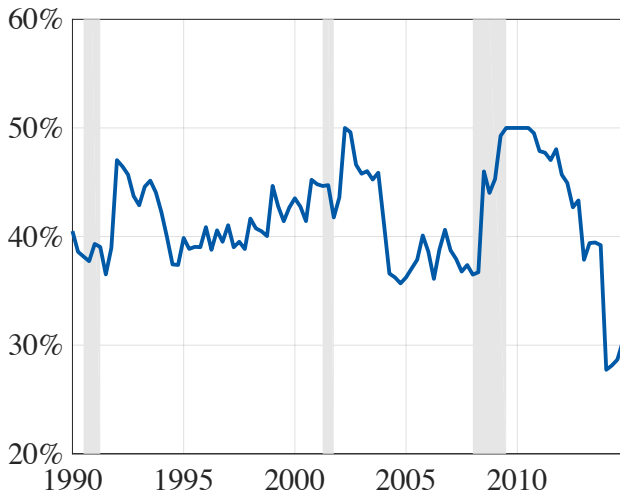
EFFICIENCY TERM  $< 0 \Rightarrow \text{UI} < \text{BAILY-CHETTY}$



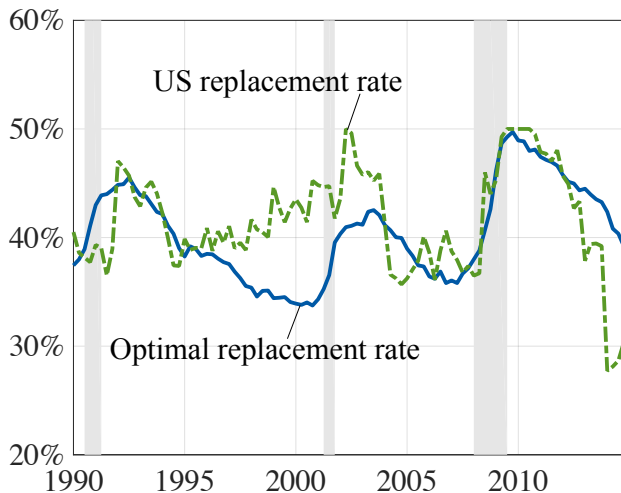
EFFICIENCY TERM  $> 0 \Rightarrow UI > \text{BAILY-CHETTY}$



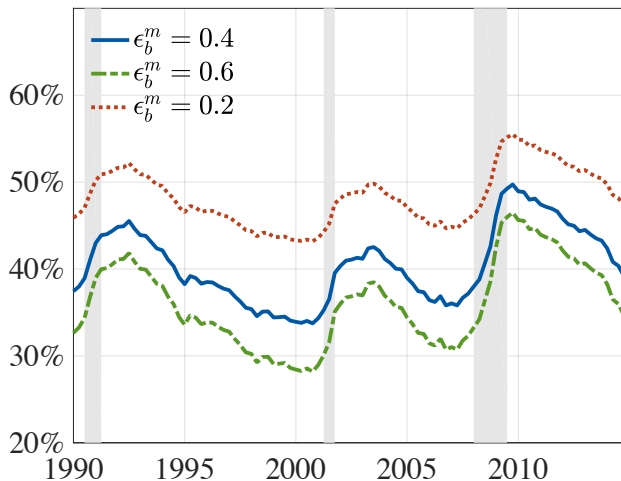
## EFFECTIVE REPLACEMENT RATE IN THE US



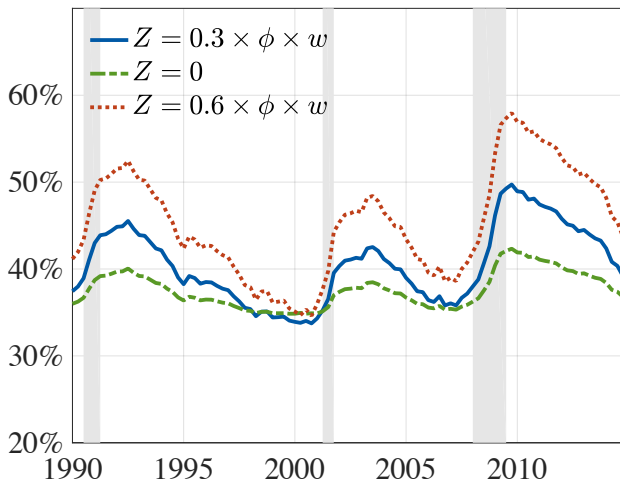
# OPTIMAL REPLACEMENT RATE IN THE US



# SENSITIVITY ANALYSIS: MICROELASTICITY

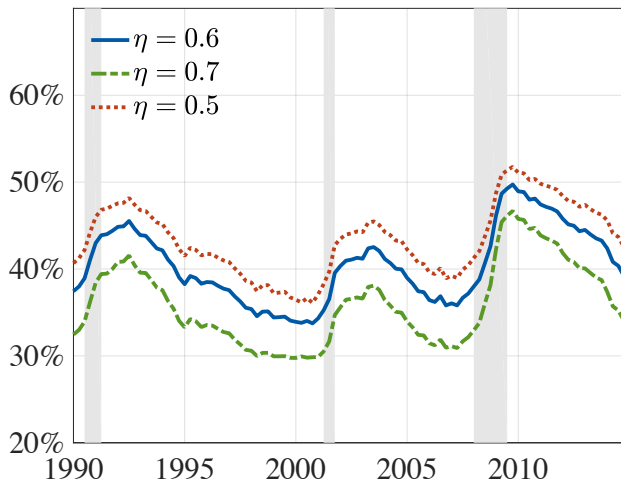


# SENSITIVITY ANALYSIS: COST OF UNEMPLOYMENT

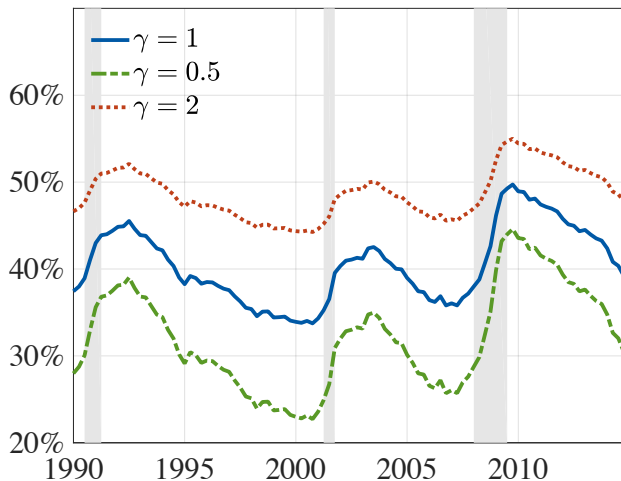




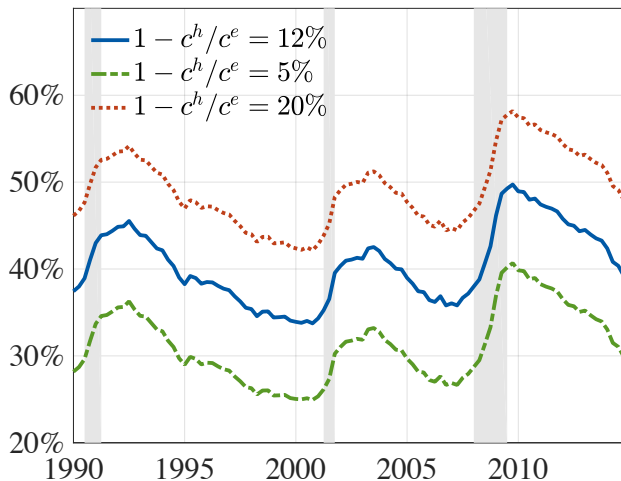
# SENSITIVITY ANALYSIS: MATCHING ELASTICITY



# SENSITIVITY ANALYSIS: RISK AVERSION



# SENSITIVITY ANALYSIS: CONSUMPTION DROP

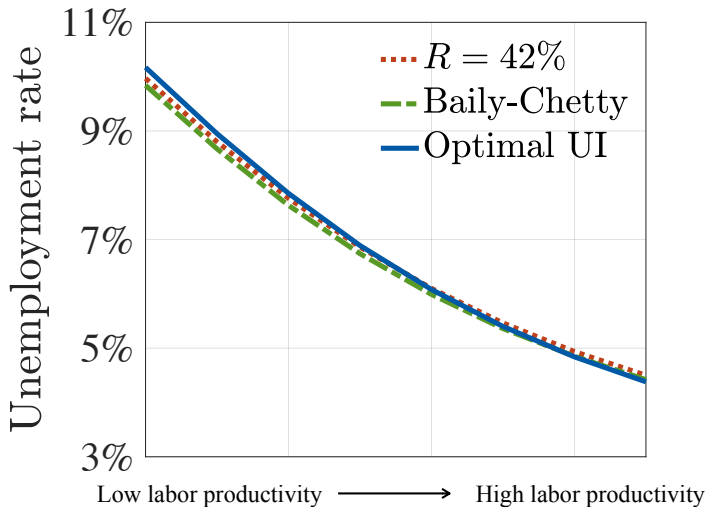


# OPTIMAL UI OVER THE BUSINESS CYCLE: SIMULATIONS OF JOB-RATIONING MODEL

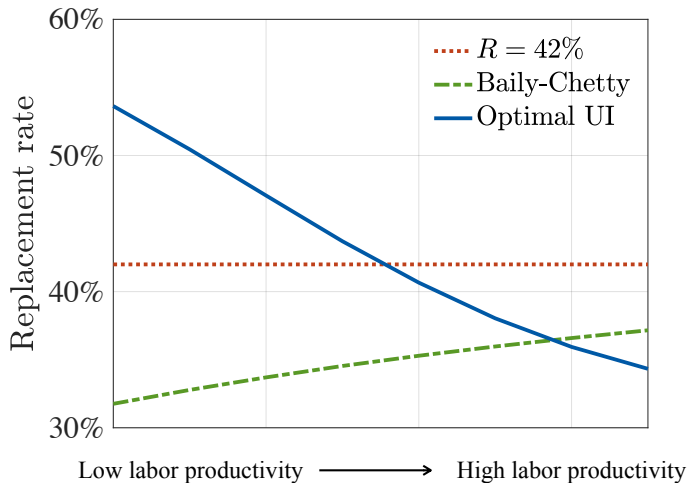
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Parameter	Description	Source
$\alpha = 0.73$	Production function: concavity	$1 - \frac{\epsilon^M}{\epsilon^m} = 0.4$
$\gamma = 1$	Relative risk aversion	Chetty [2006]
$s = 2.8\%$	Monthly job-separation rate	CPS, 1990–2014
$\eta = 0.6$	Matching elasticity	Petrongolo, Pissarides [2001]
$\mu = 0.60$	Matching efficacy	$\theta = 0.43$
$\rho = 0.80$	Matching cost	$\tau = 2.3\%$
$\zeta = 0.5$	Real wage: rigidity	Michaillat [2014]
$\omega = 0.73$	Real wage: level	$u = 6.1\%$
$\sigma = 0.17$	Disutility from home production: convexity	$\frac{d \ln(c^h)}{d \ln(c^u)} = 0.2$
$\xi = 1.43$	Disutility from home production: level	$1 - \frac{c^h}{c^e} = 12\%$
$\kappa = 0.22$	Disutility from job search: convexity	$\epsilon_b^m = 0.4$
$\delta = 0.33$	Disutility from job search: level	$e = 1$
$z = -0.14$	Disutility from unemployment	$Z = 0.3 \times \phi \times w$

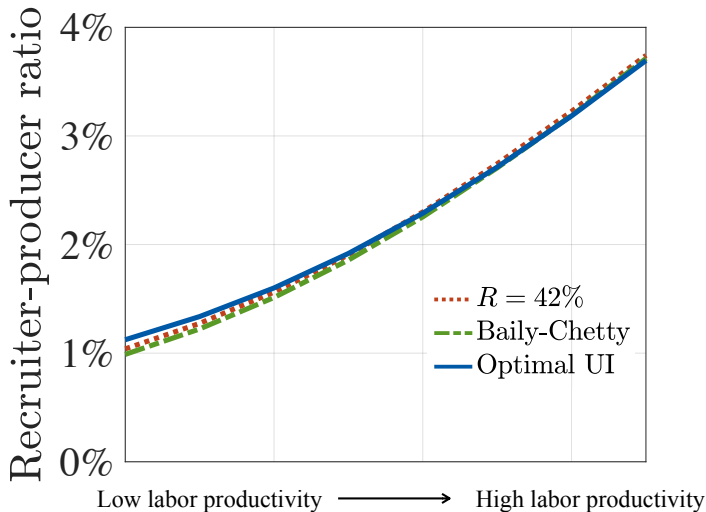
# UNEMPLOYMENT RATE OVER THE CYCLE



# REPLACEMENT RATE OVER THE CYCLE

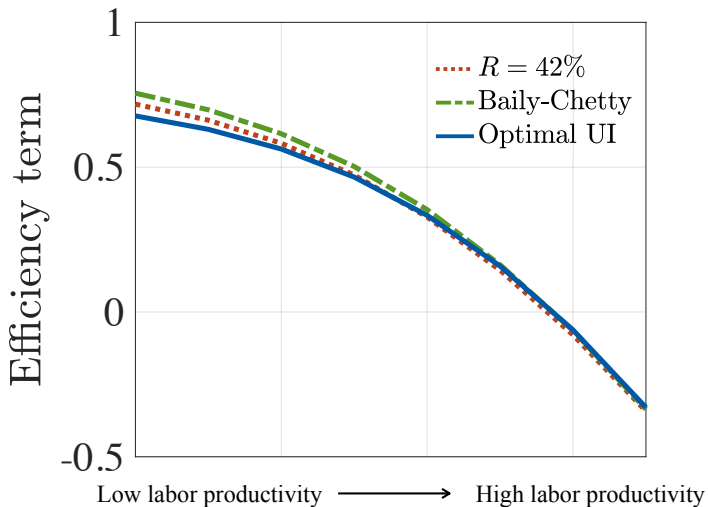


# RECRUITERS/PRODUCERS OVER THE CYCLE

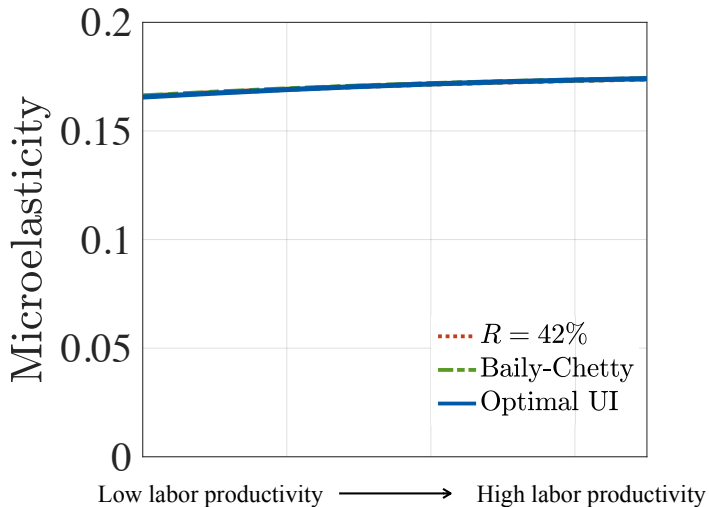




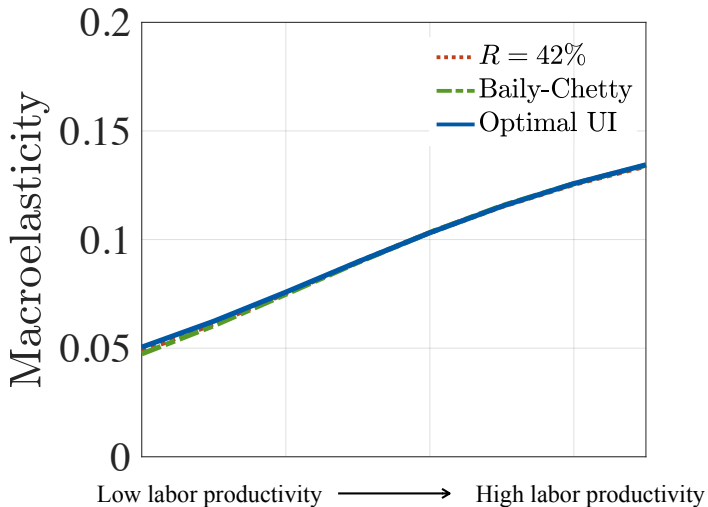
## EFFICIENCY TERM OVER THE CYCLE



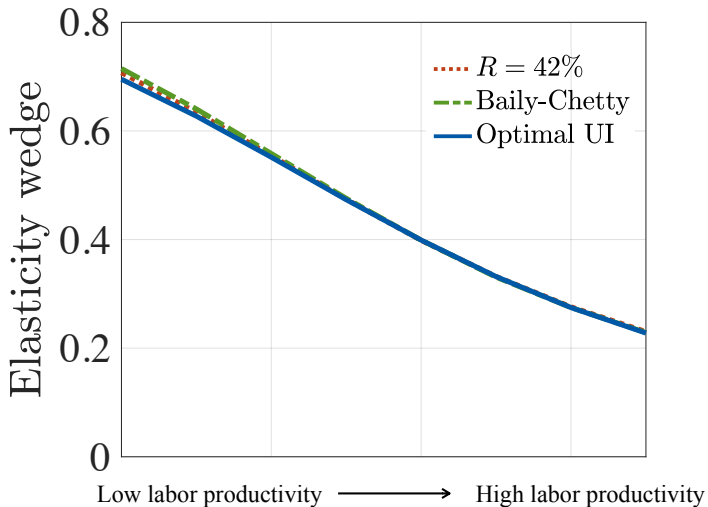
## MICROELASTICITY OVER THE CYCLE



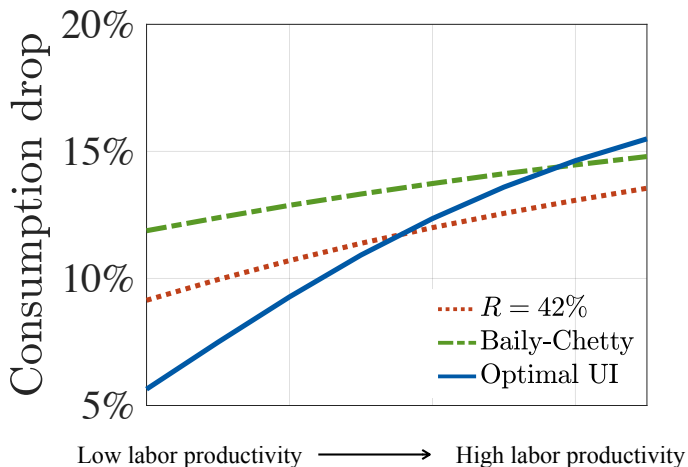
# MACROELASTICITY OVER THE CYCLE



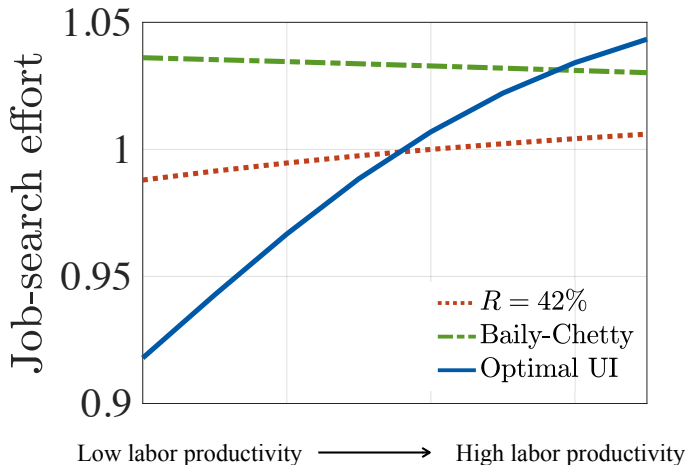
## ELASTICITY WEDGE OVER THE CYCLE



# CONSUMPTION DROP OVER THE CYCLE



## JOB SEARCH OVER THE CYCLE



# HOME PRODUCTION OVER THE CYCLE

